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# Effects of the Oil Export Price Increase on the Economy of Kazakhstan: Results from the Sensitivity Analysis

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## Abstract

This paper studies the effects of the oil export price increase on the Kazakhstani model using Lofgren et al.'s (2002) CGE model. In addition it examines the sensitivity of the results with respect to the underlying structural parameters. The paper finds that some results are robust and some are not robust to different configurations of parameters.

*Keywords:* CGE modeling; Monte-Carlo approach; oil export price.

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## 1. Main text

Much has been said and written about the possible effects of the oil export price increase on the Kazakhstani economy in general; however, little has been done to quantify the possible effects of the oil export price increase or a boom in the oil sector on the Kazakhstani economy at a more detailed sectoral level. The literature on these effects is far from complete. Therefore, to fill this gap in the literature, I attempt to quantify the possible effects of the oil export price increase by applying Lofgren et al.'s (2002) CGE model to a complete version of the SAM for Kazakhstan, which incorporates 55 sectors and conduct the sensitivity analysis.

In addition, I aim to test the implications of various macro closure rules at a more detailed sectoral level. The analysis conducted here will show whether alternative macro closure rules might lead to different results.

Specifically, in this paper I pursue three aims. *First*, I aim to quantify the effects of the oil export price increase on Kazakhstan's economy. I attempt to explain the mechanisms through which the oil export price increase affects sectoral outputs, exports, imports, private consumption, investment, and the real. *Second*, I aim to analyze whether different macro closure rules lead to different results. Here, I show how sensitive the results are with respect to different macro closure rules compared with the two-sector version of the model. *Third*, I aim to conduct the systematic sensitivity analysis that determines which structural parameters play a role in determining the outcomes of the selected variables of interest.

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In this paper, I discuss the effects of the 35-percent increase in the oil export price on the non-oil economy of Kazakhstan under alternative macro closure rules by applying Lofgren et al.'s (2002) model to the complete version of the SAM for Kazakhstan. In particular, I discuss the effects of the oil export price increase on the economy in the medium run, *first*, under the neoclassical closure rule, *second*, under the Johansen closure rule, and *finally*, under the foreign closure rule. I do not discuss the effects of the oil export price increase on the crude petroleum and natural gas sector itself here because it is quite natural to expect that the crude petroleum and natural gas sector expands in the wake of the oil export price increase.

Since the structural parameters used in the study are entirely excerpted from the literature, it is necessary to determine the robustness of the results with respect to these parameters. Conventionally, this is performed using a sensitivity analysis, defined in the literature as “the study of how the variation in the output of a model can be apportioned, qualitatively or quantitatively to different sources of variation and of how the given model depends upon the information fed into it” (Saltelli et al., 2000).

Despite the popularity of sensitivity analysis now, it was not popular until the very early 1980s. The popularity of sensitivity analysis in economic research can be largely attributed to Leamer. He was among the first researchers who stressed the importance of conducting sensitivity analysis in economic science. In his study, Leamer (1985) underlines the strong need for the “organized sensitivity analyses in economics” that he calls “global sensitivity analyses”.

The present study employs a systematic sensitivity analysis based on the Monte-Carlo approach. To some extent, it was inspired by Jensen and Tarr's (2008) study. Jensen and Tarr's (2008) study examined the robustness of the results using the Monte-Carlo approach. The accuracy of the Monte-Carlo approach strongly depends on the number of runs. This approach delivers reliable and systematic insights if the number of model runs is sufficiently high (Haber, 1970; Arndt, 1996). In the present study, as in Jensen and Tarr's (2008) study I ran the model 30,000 times, which should be sufficient to obtain plausible results.

Given the sectoral disaggregation, the model employs 243 exogenous parameters: 41 Armington elasticities of substitution, 41 elasticities of transformation, 52 income elasticities of the demand of rural households, 52 income elasticities of the demand of urban households, 55 elasticities of substitution between capital and labor, and 2 Frisch parameters for urban and rural households. I assume that the parameters are stochastically independent. Given no prior information concerning the distribution of the parameters, I assume the uniform distribution for all parameters.

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